



Making the Best of What You've Got

Optimizing Military Water Treatment Plant Processes for *Cryptosporidium* Removal & Regulatory Compliance

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BRIEFING OUTLINE

PURPOSE: Explain how optimizing an Army water system can meet multiple regulatory and treatment objectives.

1. Background
2. Case study
3. Conclusions
4. Recommendations



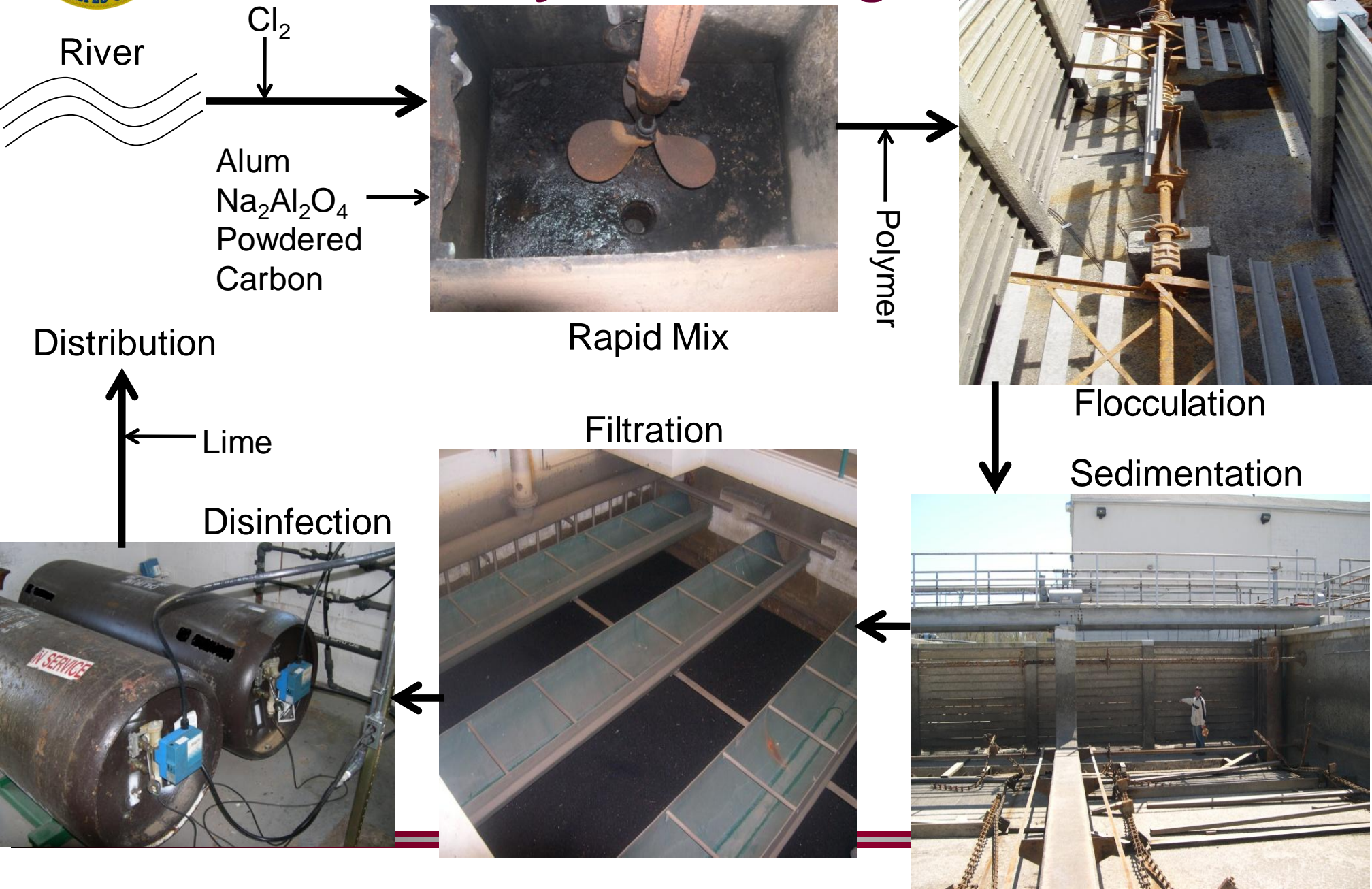
Regulatory Background

- Long Term 2 Enhanced Surface Water Treatment Rule
 - LT2ESWTR
 - Affects relatively small number of military water systems
 - Army ~ 20 water systems*
 - But, affects large population
 - Army ~ 0.3 million persons served
 - Purpose: Reduce acute health risks associated with microbial pathogens
 - Specifically *Cryptosporidium*

* Includes privatized water systems



Water System Background

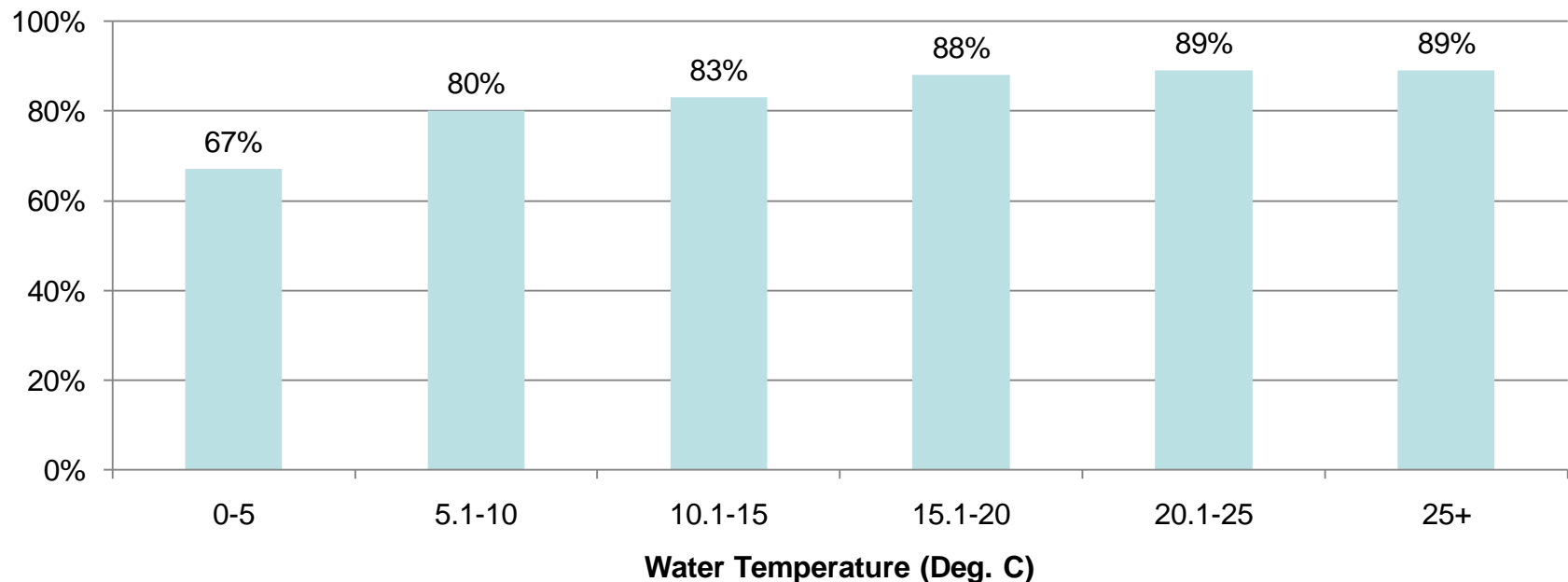




Case Study-Challenges

- Additional treatment required for LT2ESWTR
 - Provide additional 1-log *Cryptosporidium* treatment
- Cold water treatment challenges
 - Resulting scrutiny from state regulatory agency

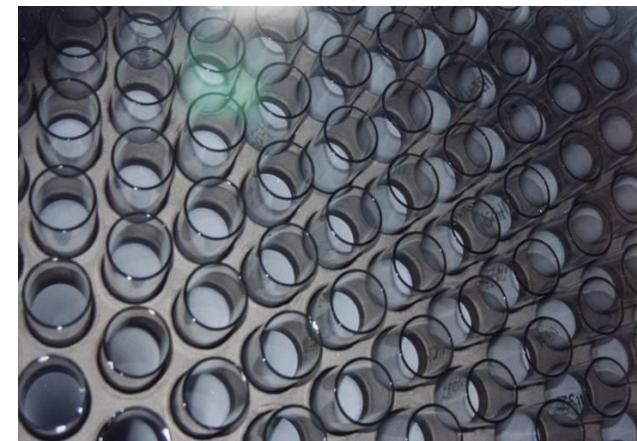
**Average Percent Turbidity Removal Through Sedimentation
Jan 06 - Jan 10**





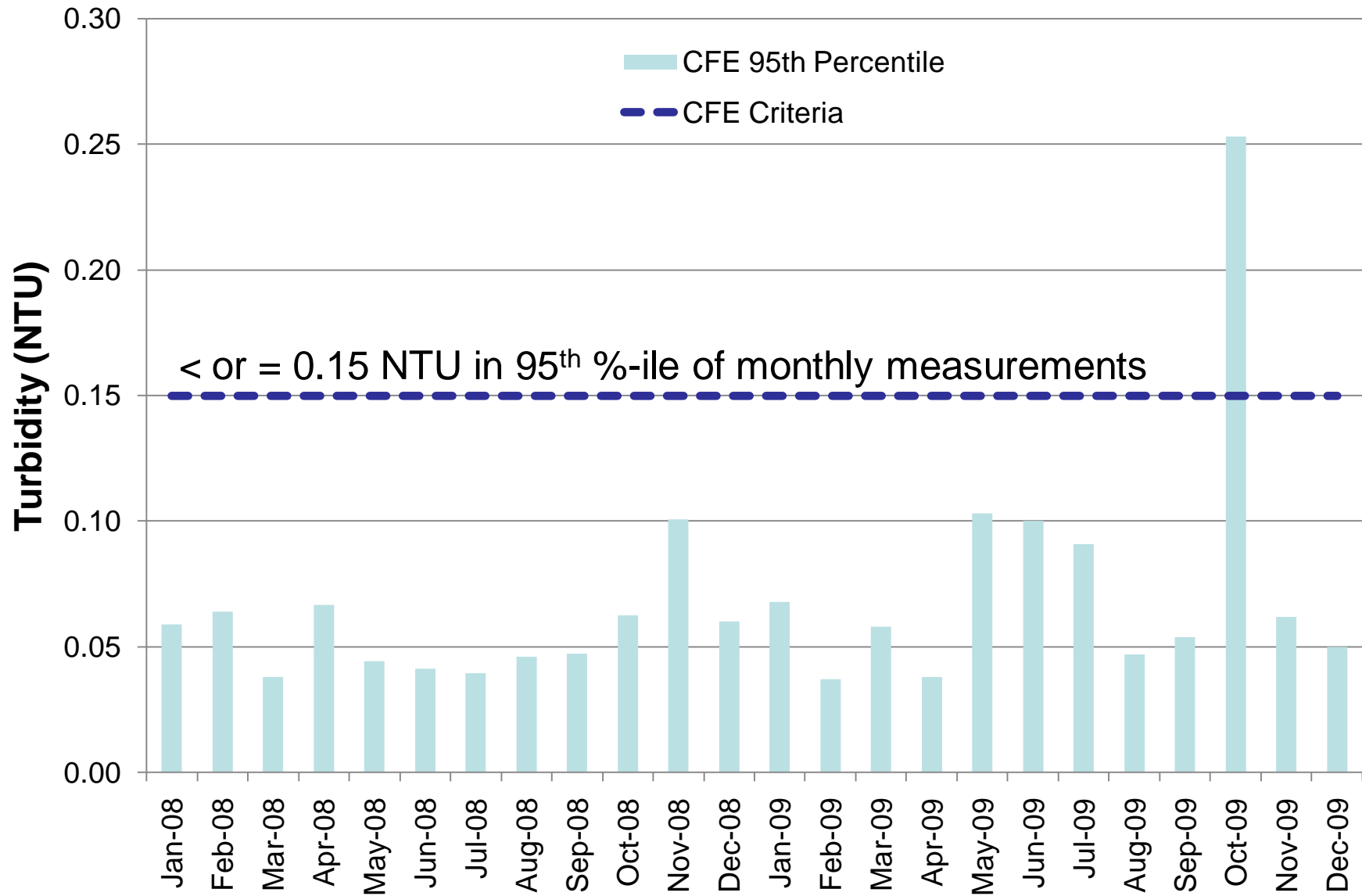
Case Study-Goals

- Identify options to meet both challenges
 - Single
 - Advanced filtration (\$\$\$-\$\$\$\$)
 - Advanced disinfection (\$\$-\$\$\$\$)
 - Optimized filtration performance (\$-\$)
 - Multiple
 - Presedimentation + 1 more (\$\$\$-\$\$\$\$)
 - Watershed protection + 1 more (\$-\$\$\$)
- Ensure simultaneous compliance
 - Lead and Copper Rule
 - Stage 2 Disinfectants and Disinfection Byproducts Rule



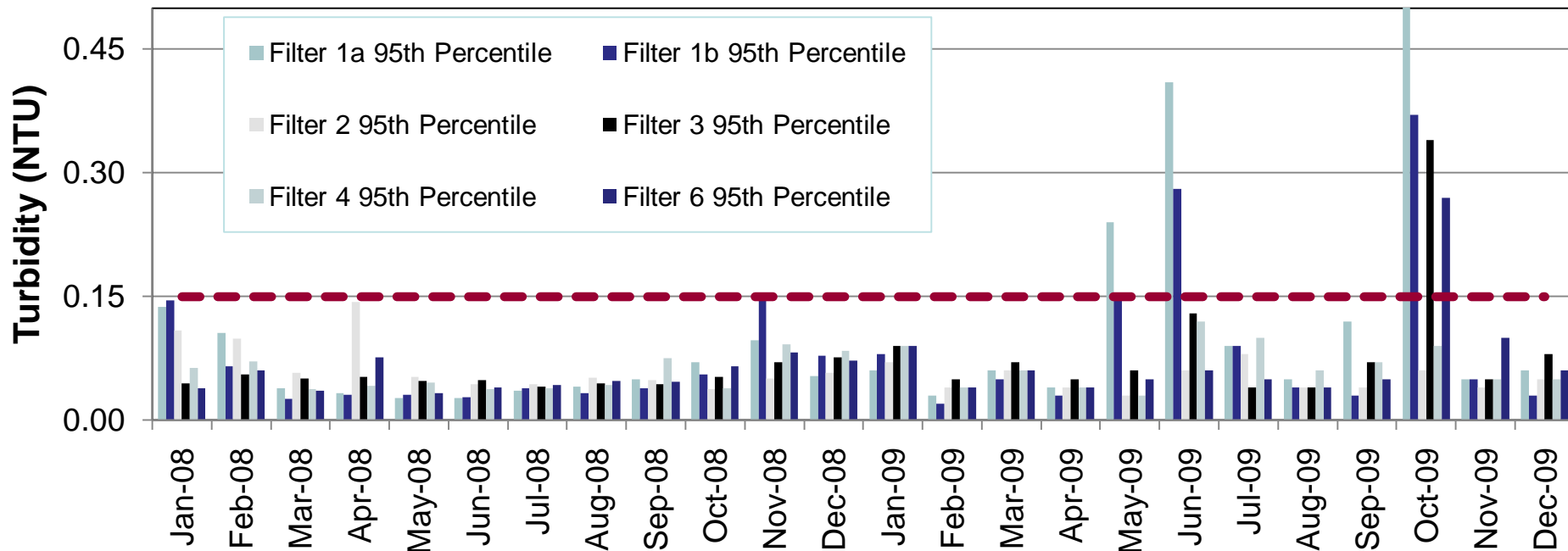


Optimized Filtration – CFE Criteria





Optimized Filtration – IFE Criteria

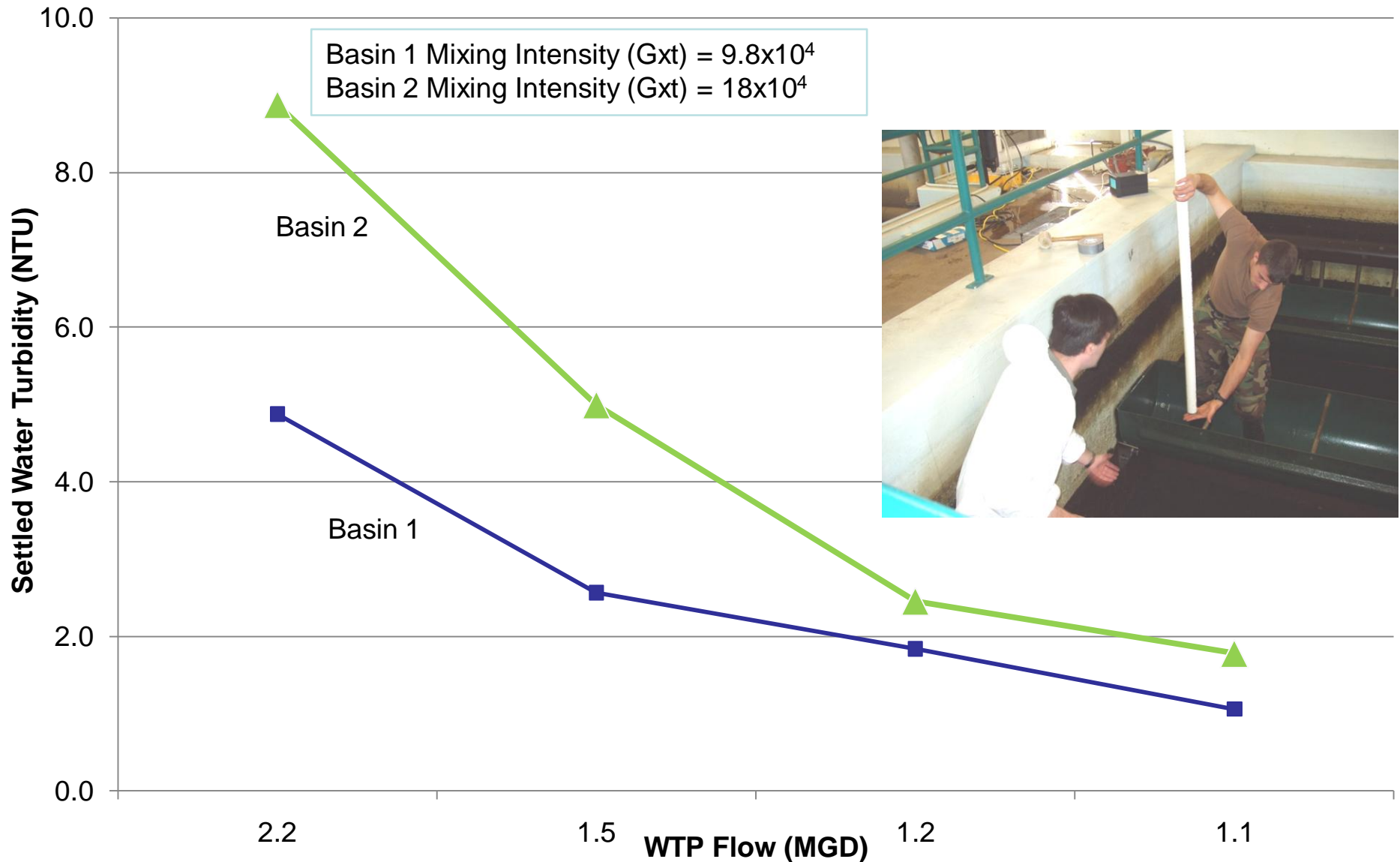


Monthly samples > 0.3 NTU in two consecutive measurements

| | | | |
|--------|--------|--------|--------|
| Jan 08 | Jul 08 | Jan 09 | Jul 09 |
| Feb 08 | Aug 08 | Feb 09 | Aug 09 |
| Mar 08 | Sep 08 | Mar 09 | Sep 09 |
| Apr 08 | Oct 08 | Apr 09 | Oct 09 |
| May 08 | Nov 08 | May 09 | Nov 09 |
| Jun 08 | Dec 08 | Jun 09 | Dec 09 |



Optimized Performance - Flocculation





Optimized Performance - Coagulation

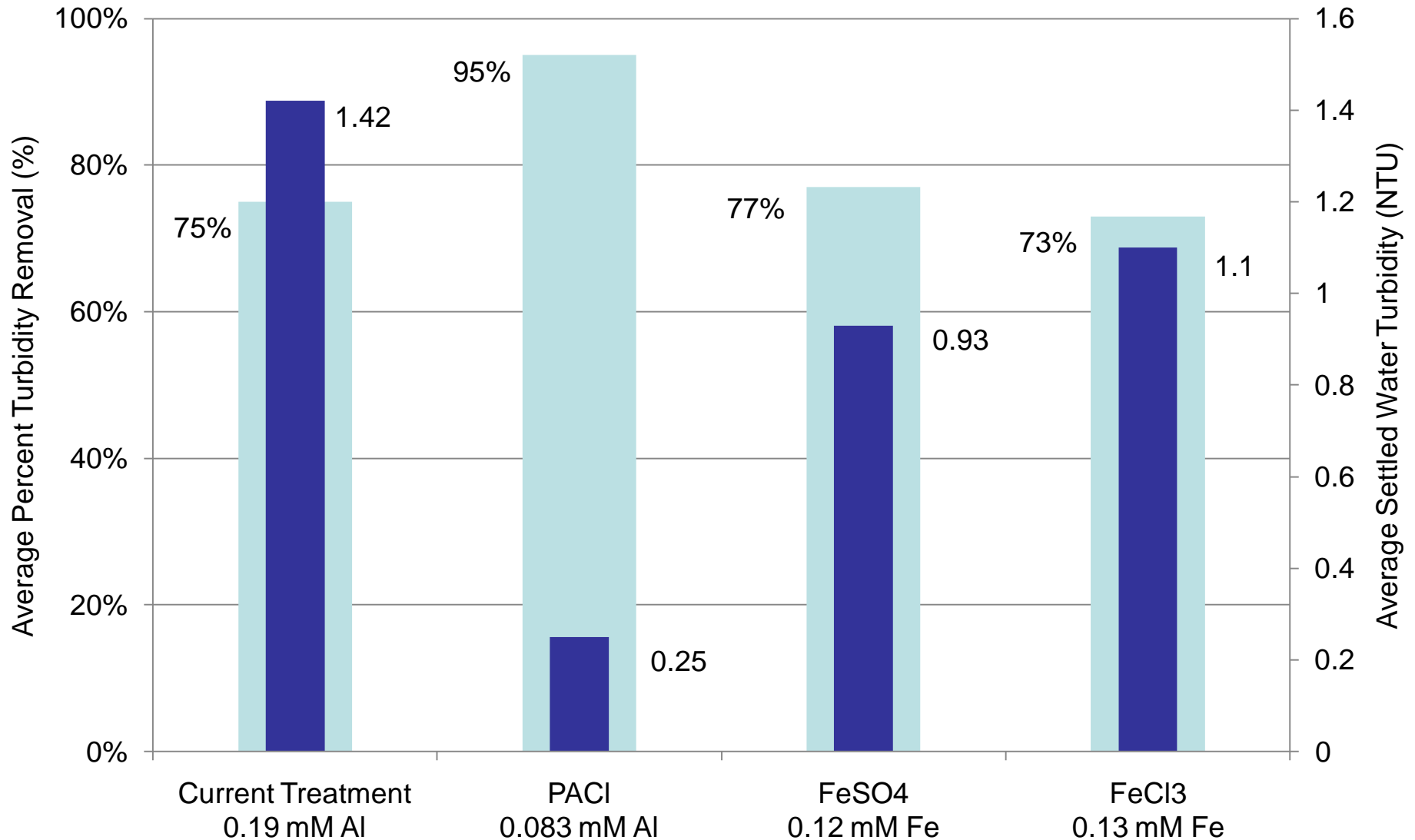
- Evaluate alternative coagulants
 - Polyaluminum Chloride (PACl)
 - Ferric Sulfate (FeSO_4)
 - Ferric Chloride (FeCl_3)
- Benefits
 - Cold water effective
 - Regional experience
 - Reduced chemical usage





Alternative Coagulant Performance

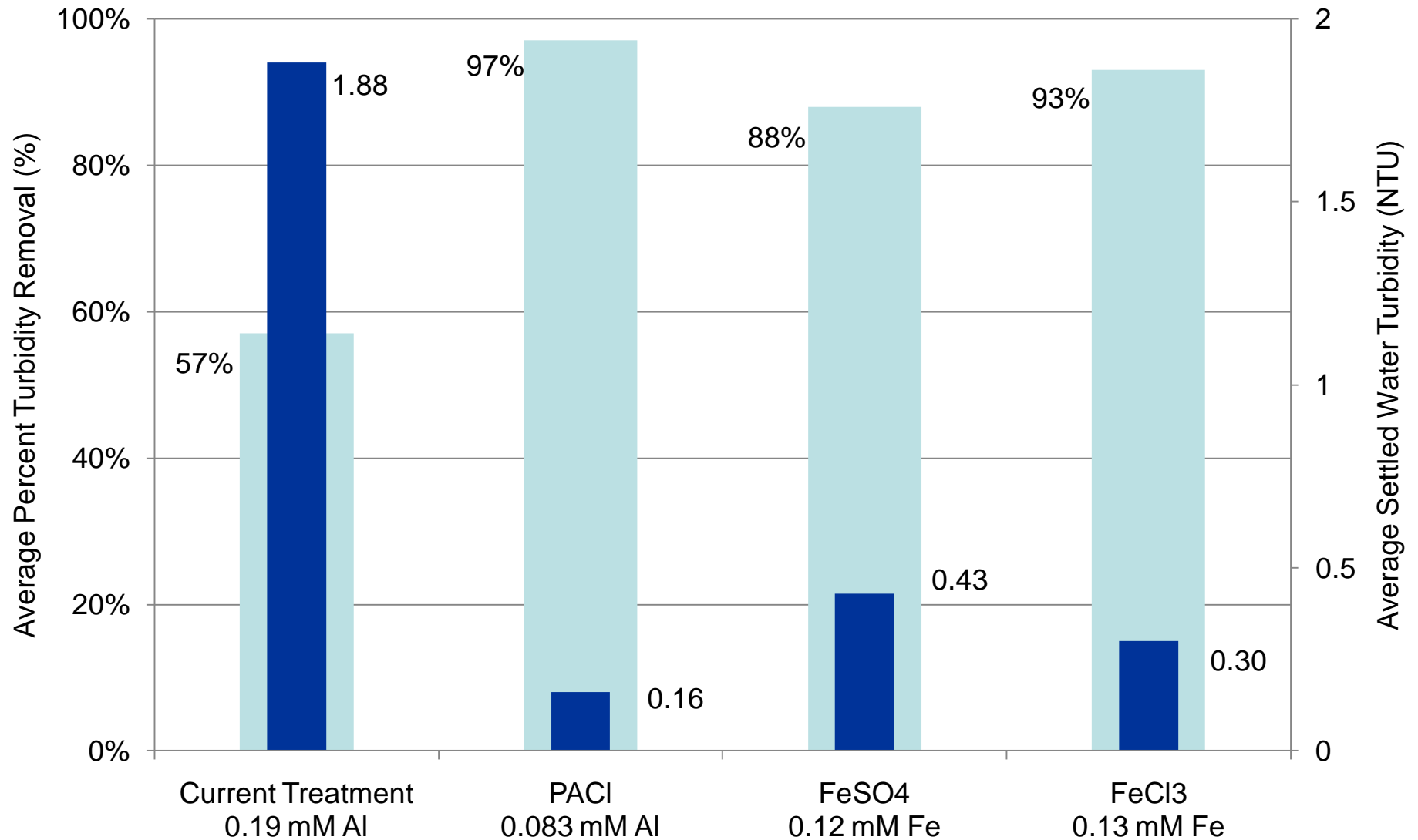
Cold Water Turbidity Removal Performance (1-13 °C)





Alternative Coagulant Performance

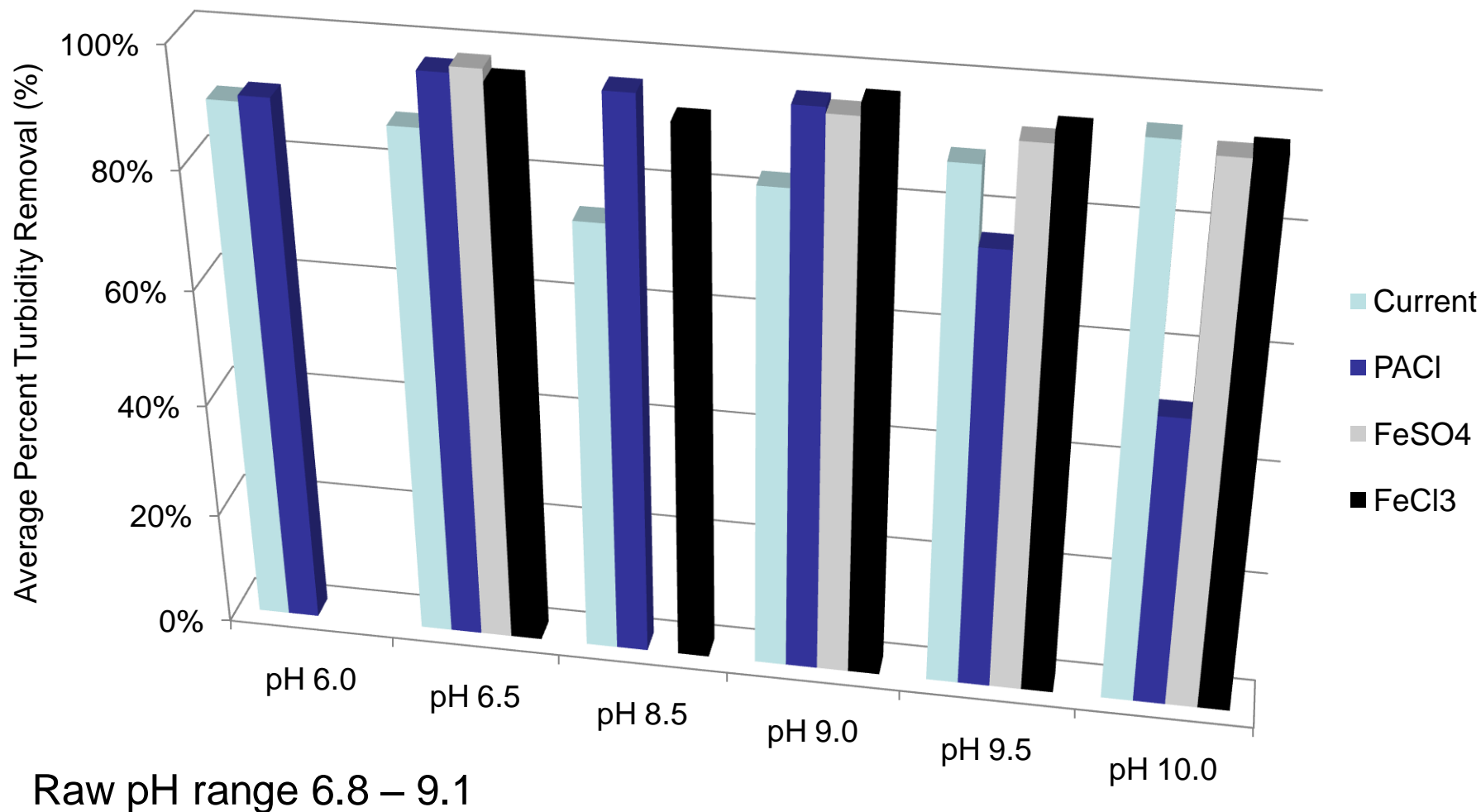
Seasonal Turbidity Removal Performance





Alternative Coagulant Performance

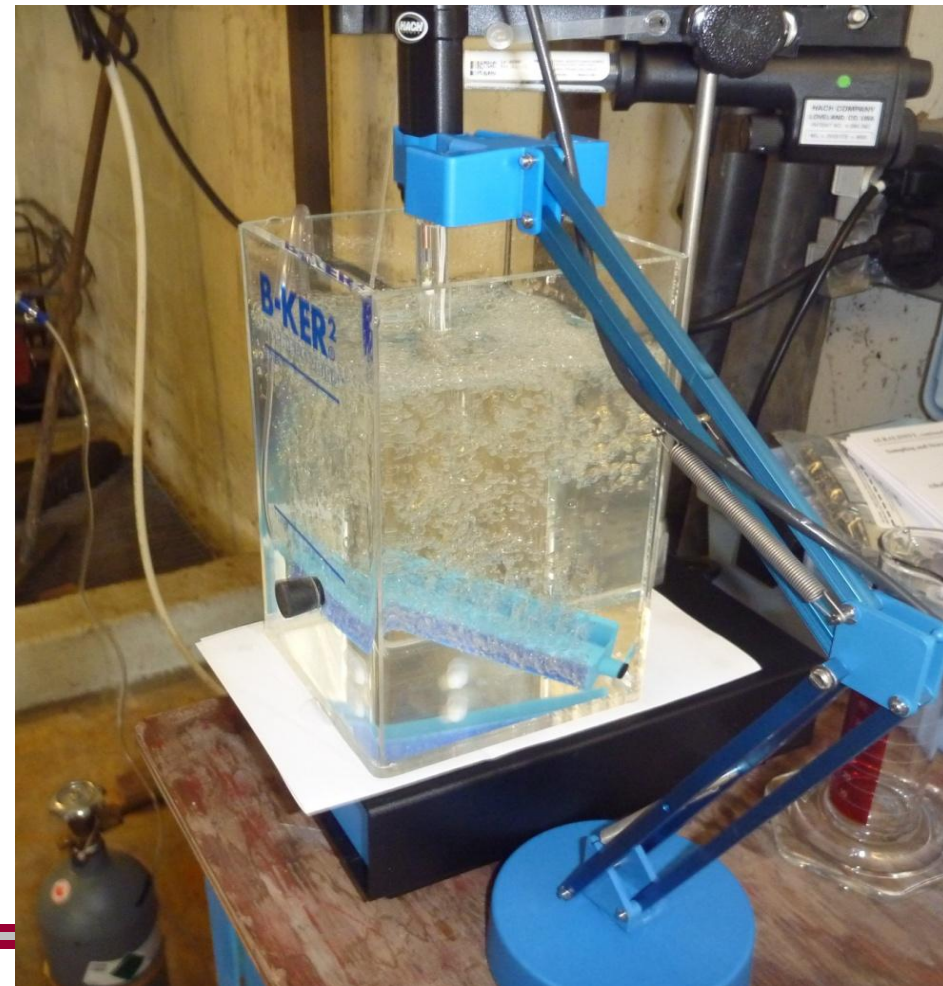
Low and High pH Range Turbidity Removal Performance





Simultaneous Compliance

- Stage 2 Disinfectants & Disinfection Byproducts Rule
 - PACI could increase disinfection byproduct formation
 - Removes less organic matter
 - May require acid addition
 - Carbon dioxide
- Lead and Copper Rule
 - May increase corrosion
 - Orthophosphate addition





Costs-Annual Chemical Usage

| | Current Treatment | PACI | FeCl ₃ | FeSO ₄ |
|----------------------------------|-------------------|-----------------|-------------------|-------------------|
| Coagulant (\$/yr) | \$70,000 | \$50,000 | \$40,000 | \$70,000 |
| Post-Lime feed (\$/yr) | \$13,000 | \$6,000 | \$12,000 | \$9,000 |
| CO ₂ addition (\$/yr) | - | \$9,000 | - | - |
| PO ₄ addition (\$/yr) | - | \$6,000 | \$6,000 | \$6,000 |
| TOTAL | \$83,000 | \$71,000 | \$58,000 | \$85,000 |
| Sludge production (Tons/yr) | 26 | 17 | 34 | 42 |



Conclusions

- LT2ESWTR compliance and cold water treatment?
 - Optimizing flocculation not enough
 - Switching to PACl will work
 - CO₂ addition necessary at pH > 9.0
 - Iron coagulants not much better in cold water
- Simultaneous compliance
 - PACl: CO₂ addition to improve organics removal
 - Alternative coagulants: orthophosphate addition for corrosion control



Recommendations

- Conduct full-scale trial of PACI
- Improve overall treatment
 - Flocculation
 - Install variable frequency drives
 - Increase size of baffle wall openings
 - Adjust filter operations
 - Install online raw water monitoring equipment



Questions?

